THE RELATION OF HIGH SCHOOL SCHOLARSHIP

TO COMBINED INTELLIGENCE AND ATTITUDE SCORES

by

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INTRODUCTION

The purpose of this study is to show the effect of attitude in combination with intelligence tests in the prediction of school achievement for high school freshmen.

The objective in mind in making this study was to enable the school administrator to predict the success of students by means of attitude as well as intelligence measurement. It is quite evident that the prediction of success by intelligence testing has not accomplished all that is possible as a predictive agency. It is therefore necessary that we look elsewhere for a method of measuring other factors which make for successful school achievement.

In measuring various phases of personality such as attitude or intelligence, the former has been found to be the more difficult. This is perhaps the reason why less has been done in the testing of attitudes, and that the field is comparatively new.

It is well known that there are many students in school whose achievement does not correlate well with their intelligence as determined by test. These students are problems of the school administrator who require adjustment, and it is for them that we are looking toward the measurement of attitude as a possible solution of at least part of the

problem.

The subjective method of measuring attitude is perhaps
as old as education itself. School administrators speak
freely of attitude but make no attempt to qualify their
statements by any scientific measurements. The personnel
worker has for a long time used questions pertaining to
attitude but has made no scientific calculations to show
that his results are valid. Dr. F. K. Shuttleworth says,
"Personnel workers have been inveterate builders of ques-
tionnaires which ask for supposedly significant facts con-
cerning the environmental background but the author has yet
to single out a single report of a systematic tabulation of
the elements of such information blanks to determine whether
the questions asked are really significant." An attempt has
been made in this study to use the scientific method in se-
curing, tabulating and treating all data.

ATTITUDE LITERATURE

The literature on attitude would be very extensive, if
we were to consider the type which is subjective in nature.
However, very little scientific study of attitude was under-
taken until about the year 1920, and even at the present
time the experimenters with attitudesreactions are rela-
tively few.

Two important studies which will be considered here
that pertain rather directly to this problem are those of
Dr. L. L. Thurstone of Chicago University, and Dr. F. K.
Shuttleworth formerly of Iowa State University.

Dr. Thurstone has made a study of attitudes as express-
ed by opinions and has devised a scale for the measurement
of attitudes toward particular issues such as militarism,
the church, etc. He has found the method of correlation to
be impractical for his work in comparing opinions and has
by scientific methods prepared a linear scale for measur-
ing attitudes by expressed opinions. This scale is system-
atically arranged so as to measure the various ranges of
opinion or attitude toward any particular issue that he
chooses.

Dr. Shuttleworth has done a piece of excellent work
along a line which is more comparable with this study. He
began his experiment with college freshmen at Iowa State
University in 1924. His first attempts were to measure
special traits such as energy-laziness by the attitude ques-
tionnaire method. The results were not found to be as good
as he had hoped. It was thus necessary to abandon the idea
of measuring one trait at a time. After reformulating his
test several times according to a plan which was follow-
ed in this study good results were obtained in comparing

attitudes of students with high and low grades. There was found to be a consistent difference in the attitudes of the two groups of students.

We have record of other work being carried on at the present time. Dr. G. T. Freeman of Cornell University is conducting an experiment to determine the influence of attitude on learning. His work is very scientific, but the results are too abstract to allow interpretation in terms of this study.

MATERIALS AND PROCEDURE

The materials used in this study were the Peterson Uniform Test of Mental Performance, the Revised Army Alpha Form Vll, and an Attitude Questionnaire which the author of this manuscript prepared by selecting items from the list as given by Dr. Shuttleworth.

The preparation of the questionnaire was a very important part of the problem. The items which were selected from Dr. Shuttleworth's work had to be applicable to the high school freshmen level. The limited vocabulary and knowledge of special issues not understood by students of this age made the problem quite different from that found in dealing with college freshmen. It was the hope of the author to arrange the items in such a way as to distinguish

between the tendencies of bright and dull students. For
this reason five different items were given for each of ten
groups. Each group was meant to represent some special
tendency. For example numbers 1, 11, 21, 31, and 41 were
meant to represent independence, while numbers 3, 13, 23,
33, and 43 were to represent a like or dislike for mechan-
ical things.

The following is the questionnaire in the exact form
in which it was given.

Attitude Questionnaire

Name.............................Date of birth........

Instructions

In this test you are to in-
dicate whether you like, dislike
or feel indifferent about cer-
tain words and phrases. Notice
the sample list. After each word
or phrase are placed a D, d, ?,
l, L.
D, means you dislike very much
d, means you dislike
?, means you are indifferent
l, means you like
L, means you like very much

Thus in the Sample List, if you
neither like nor dislike the
word "pencil", you would place
a circle around the question
mar, thus, (?); or if you
like the word "contented", you
would place a circle around
the small l, thus (l) and
so on.

Sample List

pencil	D	d	(?)	l	L
contented	D	d	?	(l)	L
killing	(D)	d	?	l	L
children	D	d	?	(l)	L
happiness	D	d	?	l	(L)
disappoint	D	(d)	?	l	L

Mark the practice list
according to instructions

Practice List

dirty	D	d	?	l	L
be wealthy	D	d	?	l	L
steady	D	d	?	l	L
fast ride	D	d	?	l	L
slang	D	d	?	l	L
bully	D	d	?	l	L

You are to mark the words and phrases on the follow-
ing page in the same manner that you marked the Practice

List. Work fast. Put down you snap judgments. Mark every word.

1. argue about things......................	D	d	?	l	L
2. have a big allowance....................	D	d	?	l	L
3. invent something.......................	D	d	?	l	L
4. manage things..........................	D	d	?	l	L
5. work hard..............................	D	d	?	l	L
6. amount to something....................	D	d	?	l	L
7. church.................................	D	d	?	l	L
8. national defense.......................	D	d	?	l	L
9. do one thing at a time.................	D	d	?	l	L
10. learn more about art	D	d	?	l	L
11. do as you please once in a while......	D	d	?	l	L
12. Pierce Arrow..........................	D	d	?	l	L
13. electricity...........................	D	d	?	l	L
14. have responsibility...................	D	d	?	l	L
15. keep your promise.....................	D	d	?	l	L
16. build a reputation....................	D	d	?	l	L
17. more use of prayer....................	D	d	?	l	L
18. America first.........................	D	d	?	l	L
19. friendly gambling.....................	D	d	?	l	L
20. learn more about music................	D	d	?	l	L
21. do something new	D	d	?	l	L
22. dancing...............................	D	d	?	l	L
23. work with machinery...................	D	d	?	l	L
24. be head of a large organization.......	D	d	?	l	L
25. save every penny......................	D	d	?	l	L
26. be aggressive.........................	D	d	?	l	L
27. Christianize the world................	D	d	?	l	L
28. our country right or wrong............	D	d	?	l	L
29. murder................................	D	d	?	l	L
30. beauty................................	D	d	?	l	L
31. be your own boss......................	D	d	?	l	L
32. canoeing..............................	D	d	?	l	L
33. build a radio.........................	D	d	?	l	L
34. have influence........................	D	d	?	l	L
35. go after what you want...............	D	d	?	l	L
36. be somebody...........................	D	d	?	l	L
37. the old fashioned religion............	D	d	?	l	L
38. Star Spangled Banner..................	D	d	?	l	L
39. swearing..............................	D	d	?	l	L
40. work with delicate things.............	D	d	?	l	L
41. work by yourself....................	D	d	?	l	L
42. be lucky..............................	D	d	?	l	L
43. wireless..............................	D	d	?	l	L
44. be a leader...........................	D	d	?	l	L

45. seek the facts.......................... D   d   ?   1   L
46. get farther than your parents..........D   d   ?   1   L
47. more faith in God...................... D   d   ?   1   L
48. patriotic.............................. D   d   ?   1   L
49. easier divorce laws.................... D   d   ?   1   L
50. love................................... D   d   ?   1   L

The two intelligence tests and questionnaire were given
to the entire group of two hundred ten freshmen from five
different Kansas high schools. Sixty of this number were
eliminated in the statistical analysis due to their having
had previous experience with one of the intelligence tests.
The entire group was thus made homogeneous with respect to
previous experience with tests. Every attempt was made to
give the tests and questionnaire under uniform conditions,
although different examiners conducted the tests in differ-
ent schools.

The final grade in each subject for the year was obtain
ed and from this the grade average was calculated. Extra-
curricular activities such as music, debate, and dramatics
were not included. Approximately all of the students had
four solid subjects from which to obtain the average. The
same grading system was used in each of the five high
schools. This considerably simplified the calculation of
grade averages. The grading was as follows: A..95-100;
B..89-94; C..82-88; D..75-81 and F below 75. The grade
average was translated into numerical values according to

the following plan: A..5, B..4, C..3, D..2, and F..1.

In the grading of the questionnaire a reaction of L was given a value of 2; a reaction of l a value of 1; a ? a value of 0; d, a value of -1 and D a value of -2.

The intelligence tests were graded according to the standard directions given. The scores of the Army Alpha were interpreted entirely in terms of mental age.

STATISTICAL ANALYSIS

Through-out the analysis the boys and girls were kept separate. In the correlations the boys from the different schools as well as the girls from the different schools were kept separate until enough consistency was found to justify their being combined without significant error.

The first step in scientific treatment was to correlate grades with the results of the scores in groups which were meant to refer to some special tendency. The correlations were found to be negligible. The conclusion was drawn that the method of classification was impractical, or that the items used for each tendency were not a true measure of it.

The next plan was to find the value of each item in the questionnaire. This was done by comparing the students having the highest 20% in grades with those having the low-

est 20% in grades. The scores on each item in the quest-
ionnaire were compared for the high and low group and only
those items having a large difference were used. On this
basis a new grouping was obtained. Following are the items
which were found significant by this plan. The amount of
difference is indicated by the score following the item.
The negative sign indicates that the low group shows a
greater liking than the high group toward the item by the
amount given.

Group 1

1. argue about things....................... 35
2. invent something.........................-22
3. work hard................................. 31
4. learn more about art..................... 22
5. do as you please......................... 23
6. learn more about music................... 29
7. save every penny.........................-39
8. work with delicate things............... 29

Group 11

9. have a big allowance..................... 16
10. manage things............................-18
11. Christianize the world................... 21
12. beauty................................... 16
13. be your own boss......................... 15
14. have influence.......................... 14
15. go after what you want................... 15
16. seek the facts........................... 18

Group 111

17. church...................................-11
18. have responsibility...................... 9
19. keep your promise........................ 10
20. more use of prayer....................... 11

21. be aggressive..................... ...-11
22. murder...................................-11
23. get farther than your parents...........-14
24. easier divorce laws................... .-10

The grades of the students were then correlated with scores on the three groups of the questionnaire items. A minus value was given to the scores on the items which are marked negative. The correlations and the data used in the calculation of the regression equations are given on TABLE 1.

The formulas for writing the regression equations in TABLE 1 are found in Karl J. Holzinger's text, Statistical Methods for Students in Education.

A new composite score was thus obtained for the questionnaire. The regression coefficients were multiplied by the respective scores of the group they represented and the constant added to obtain the composite score. The following is the process using the boys' regression equation:

$$X_1 = .086x_2 + .073x_3 + .032x_4 + 2.632$$

A boy's score in group 1 is 10, in group 11 it is 8, and in group 111 it is 6. The composite score will be (10 X .086) + (8 X .073) + (6 X .032) + 2.632 = 4.208. A score obtained by this method should give the best possible estimate of attitude as measured by the three groups as far as predict-

TABLE 1 Correlations and regression equations between grades and the three groups of questionnaire items.

1--grades, 2--group 1, 3--group 11, 4--group 111

Boys

Zero Order Correlations		Standard Deviations		Means		S Values	
r 12	.358	∂1	.832	M1	3.025	S 12.34	.22425
r 13	.290	∂2	2.864	M2	1.101	S 13.24	.18660
r 14	.326	∂3	2.772	M3	5.607	S 14.23	.181040
r 23	.155	∂4	2.203	M4	3.076	S 234	.865815
r 24	.313						
r 34	.165						

Girls

r 12	.471	∂1	.830	M1	3.382	S 12.34	.337636
r 13	.336	∂2	3.712	M2	3.084	S 13.24	.183961
r 14	.166	∂3	3.130	M3	5.873	S 14.23	.075098
r 23	.313	∂4	2.195	M4	3.788	S 234	.86980
r 24	.187						
r 34	.033						

The following regression equations were used to obtain a new composite score:

Boys: $X_1 = .075x_2 + .064x_3 + .078x_4 + 2.338$
$$O(est\ X_1)\quad .731$$

Girls: $X_1 = .086x_2 + .075x_3 + .032x_4 + 2.632$
$$O(est\ X_1)\quad .769$$

TABLE 11 The grade average, questionnaire score, and intelligence scores for each student.

Boys

Student Number	Mental Age	Grade Average	Equation Completion	Questionnaire Score
1	13-0	2.25	48	-.047
2	15-3	2.50	70	4.090
3	13-3	2.50	38	2.758
4	14-9	2.75	71	1.411
5	15-0	3.00	113	4.135
6	15-3	2.75	79	2.014
7	18-0	4.25	79	4.777
8	14-3	2.50	44	1.999
9	14-0	3.25	57	2.815
10	15-0	3.50	56	2.359
11	19-6	5.00	96	4.045
12	12-3	2.00	51	-.260
13	15-9	2.00	60	2.927
14	17-0	3.25	88	3.817
15	16-9	4.00	89	5.191
16	16-6	3.25	86	4.903
17	16-9	4.25	80	1.954
18	16-3	3.50	87	.568
19	18-0	4.00	77	3.730
20	14-0	3.50	70	.700
21	15-0	2.25	92	3.343
22	15-0	3.75	58	.556
23	18-9	4.50	84	4.645
24	15-0	3.25	89	1.786
25	15-0	2.75	53	-.131
26	15-3	3.00	85	4.516
27	12-9	2.25	66	4.015
28	17-3	4.00	96	2.500
29	16-0	2.25	64	2.143
30	15-3	3.25	65	2.131
31	16-3	2.50	51	5.320
32	15-9	4.25	101	5.005
33	14-0	2.75	88	2.572
34	18-0	3.75	74	4.960
35	14-9	2.75	51	2.272
36	15-6	2.75	76	5.392
37	15-3	2.25	35	.310
38	16-0	4.75	56	5.908

TABLE 11 (Boys) continued

39	14-0	1.75	76	2.200
40	13-6	2.75	31	1.570
41	13-3	3.25	36	3.484
42	13-9	3.25	44	2.743
43	15-6	2.00	61	4.204
44	14-0	2.25	55	1.954
45	15-0	3.50	36	3.400
46	18-0	3.00	75	4.251
47	14-0	2.50	40	3.919
48	16-0	3.50	56	3.946
49	15-0	4.25	82	4.318
50	13-0	1.50	33	1.342
51	15-0	1.75	26	1.915
52	15-3	2.00	29	2.614
53	14-3	3.00	97	2.959
54	20-6	4.00	86	6.208
55	15-0	2.50	49	.256
56	16-0	3.75	54	6.250
57	19-3	5.00	128	3.142
58	17-9	3.50	86	4.804
59	15-3	3.25	77	3.289
60	13-3	1.50	42	2.410
61	15-6	2.75	70	4.003
62	14-3	2.25	78	1.729
63	16-6	2.25	96	2.788
64	15-3	3.50	83	2.674
65	14-3	2.25	25	-.632
66	13-3	3.00	76	3.973
67	12-3	2.25	52	4.231
68	14-9	2.75	12	2.074
69	14-6	3.00	62	3.172
70	16-3	2.50	94	2.485
71	14-0	1.50	59	1.858
72	16-0	3.75	90	4.903
73	16-3	2.50	85	2.845
74	13-6	1.75	51	-.221
75	16-0	3.25	75	7.534
76	16-3	4.00	72	2.416
77	13-9	3.00	67	4.918
78	14-3	4.00	85	2.455
79	17-3	4.00	91	4.447

TABLE 11 The grade average, questionnaire score, and in-
telligence scores for each student

Girls

Student Number	Mental Age	Grade Average	Equation Completion	Questionnaire Score
1	16-6	3.75	53	4.905
2	17-0	3.50	80	3.786
3	17-0	4.75	105	2.538
4	15-0	3.50	50	3.040
5	13-0	2.25	71	2.275
6	20-3	5.00	137	8.963
7	17-6	5.00	102	4.743
8	16-3	4.00	38	4.196
9	13-0	3.00	82	1.420
10	14-6	3.25	83	6.433
11	17-0	5.00	123	6.726
12	14-3	4.00	49	4.127
13	15-3	2.25	75	.415
14	15-0	2.00	52	1.237
15	15-6	4.25	80	3.024
16	16-3	2.75	55	5.305
17	13-0	3.00	67	2.013
18	16-0	3.25	64	3.819
19	13-3	3.50	72	1.256
20	14-6	2.50	82	.431
21	18-0	4.75	97	5.340
22	15-0	2.25	58	1.666
23	13-3	2.75	62	3.084
24	15-0	3.00	94	2.447
25	13-0	1.75	68	2.754
26	16-6	2.75	68	.964
27	16-6	4.25	58	5.223
28	15-6	4.00	90	3.663
29	13-0	2.00	15	.030
30	14-3	3.50	69	2.838
31	17-6	4.75	130	3.240
32	16-0	2.75	77	1.991
33	13-0	2.50	80	3.231
34	15-6	2.75	87	2.065
35	16-0	4.00	69	4.969
36	17-0	2.75	75	4.639
37	16-6	4.75	98	3.502

TABLE 11 (Girls) continued

38	16-6	3.50	97	4.327
39	16-0	3.25	79	5.029
40	15-0	2.75	33	3.857
41	17-0	3.75	49	3.016
42	13-3	3.00	36	3.324
43	17-9	4.00	75	1.819
44	17-0	4.00	93	3.223
45	17-6	4.00	111	4.468
46	18-3	4.50	125	5.499
47	13-6	3.00	41	1.210
48	16-3	3.75	50	6.171
49	13-9	2.50	31	3.122
50	14-6	3.50	90	.554
51	15-6	3.25	77	3.054
52	15-3	2.50	60	3.524
53	15-0	3.00	40	3.556
54	12-6	3.50	23	2.644
55	15-3	2.50	45	4.264
56	15-6	2.25	56	3.248
57	18-6	4.00	71	2.814
58	15-3	4.00	71	3.657
59	16-0	2.75	71	1.303
60	17-6	3.75	109	5.251
61	17-3	3.25	82	5.647
62	15-3	2.50	78	5.313
63	14-6	2.75	80	.792
64	13-3	2.75	60	3.185
65	14-6	2.50	85	2.729
66	14-3	3.00	39	2.855
67	17-3	4.75	99	3.701
68	18-6	5.00	88	6.865
69	16-3	3.75	87	3.540
70	16-3	3.50	63	.816
71	16-9	3.75	86	3.010

TABLE 111 Correlation results between grades and the other three variables.

1--grades, 2--questionnaire, 3--equation completion, 4--mental age.

	Girls			Boys	
		Zero Order Correlations			
r 12	.501	$\pm$.059	r 12	.422	$\pm$.062
r 13	.664	$\pm$.044	r 13	.462	$\pm$.059
r 14	.538	$\pm$.056	r 14	.632	$\pm$.045
r 23	.154	$\pm$.078	r 23	.363	$\pm$.065
r 34	.627	$\pm$.048	r 34	.512	$\pm$.055
r 24	.549	$\pm$.055	r 24	.475	$\pm$.058
		First Order Partial Correlations			
r 12.3	.540	$\pm$.056	r 12.3	.308	$\pm$.068
r 14.3	.209	$\pm$.076	r 14.3	.520	$\pm$.055
r 24.3	.587	$\pm$.052	r 24.3	.361	$\pm$.065
r 13.2	.686	$\pm$.042	r 13.2	.366	$\pm$.065
r 14.2	.364	$\pm$.069	r 14.2	.541	$\pm$.053
r 34.2	.657	$\pm$.045	r 34.2	.414	$\pm$.062
		Second Order Partial Correlations			
r 12.34	.529	$\pm$.057	r 12.34	.151	$\pm$.074
r 13.24	.638	$\pm$.047	r 13.24	.179	$\pm$.073
r 14.23	-.158	$\pm$.078	r 14.23	.460	$\pm$.059
		Multiple Correlations			
R1(23)	.777	$\pm$.031	R1(23)	.537	$\pm$.053
R1(24)	.592	$\pm$.051	R1(24)	.647	$\pm$.044

TABLE 111   continued

R1(34)	.682	$\pm$.042	R1(34)	.651	$\pm$.043
R1(234)	.784	$\pm$.030	R1(234)	.663	$\pm$.042

TABLE 1V   Data used in the calculation of the regression equations

1--grades, 2--questionnaire, 3--equation completion, 4--mental age.

	Girls		Boys

Standard Deviations (Third Order)

σ1.234	.515	σ1.234	.621
σ2.134	1.157	σ2.134	1.432
σ3.124	14.212	σ3.124	18.338
σ4.123	.986	σ4.123	1.164
σ1.23	.521	σ1.34	.629
σ2.13	1.419	σ3.14	18.477
σ3.12	17.82	σ4.13	1.202

Means

M1	3.382	M1	3.025
M2	3.380	M2	3.050
M3	68.870	M3	68.03
M4	15.827	M4	15.189

TABLE 1V continued

Standard Deviations

σ_1	.830	σ_1	.832
σ_2	.854	σ_2	1.671
σ_3	24.811	σ_3	22.022
σ_4	1.585	σ_4	1.641

Regression Coefficients

b 12.34	.235	b 12.34	.065
b 13.24	.023	b 13.24	.006
b 14.23	.082	b 14.23	.245
b 12.3	.196	b 13.4	.007
b 13.2	.020	b 14.3	.263

Regression Equations

Girls

$$X_1 = .235x_2 + .023x_3 - .082x_4 - .293$$
$$\sigma(\text{est } X_1)\ .515$$

$$X_1 = .198x_2 + .020x_3 + 1.335$$
$$\sigma(\text{est } X_1)\ .521$$

Boys

$$X_1 = .065x_2 + .006x_3 + .245x_4 - 1.272$$
$$\sigma(\text{est } X_1)\ .621$$

$$X_1 = .007x_3 + .263x_4 - 1.410$$
$$\sigma(\text{est } X_1)\ .629$$

ing grades is concerned. This score is the questionnaire score as given in TABLE 11.

In TABLE 111 are given the results of the inter-correlations between grades, the questionnaire score, the equation completion score and the mental age for both boys and girls.

All the formulas for calculating the first order partials, second order partials, and multiple correlations as well as regression equations as given in TABLES 111 and 1V were obtained from Henry E. Garrett's text, Statistics in Psychology and Education.

The accuracy of the multiple correlations was checked by means of two different formulas given by Garrett. The partial correlations were checked by means of a formula given by Lorrell E. Kelly, Journal of Educational Psychology, February 1929. This formula calculates multiples by means of zero order correlations and is thus a check to determine the correctness of the partials used in the other formulas. The formula is:

$$R1(23) = \frac{r_{12} + r_{13} - 2r_{12}r_{13}r_{23}}{1 - r_{23}}$$

The multiple correlation results as given in TABLE 111 show that a finer prediction of grades in every case with both boys and girls can be made with a combination of the

intelligence test and attitude questionnaire as a battery
of tests, than by any two of the variables. The improve-
ment of the three as a battery over two is not large enough
to show an entirely reliable difference. By figuring the
P. E. (diff.) I find that there are only 54 chances out of
100 of a real difference for girls in the combined battery
over the Equation Completion Test and Attitude Question-
naire. In the case of the boys the P. E. (diff.) shows
that there are 55 chances out of 100 of a real difference
in the combined battery over the Equation Completion Test
and Mental Age.

The σ(est) represents how accurately the battery pre-
dicts grades. For example in case of girls with the entire
battery the σ(est X_1) was .515. This means that we can pre-
dict within .515 grade units of the true grade 68 times in
100, and that 98 times in 100 we could predict within 2
.515 or 1.030 grade units. The same application can be
made to the other σ(est)'s.

An example of the use of the regression equation: A
certain boy had a questionnaire score of $4.447 = x_2$, an
equation completion score of $91 = x_3$, and a mental age of
$17.25 = x_4$. Applying the regression equation we have

$$X_1 = .065x_2 + .008x_3 + .245x_4 - 1.272$$

$$X_1 = (.065 \times 4.447) + (.006 \times 91) + (.245 \times 17.25) - 1.272$$

$$X_1 = 3.788$$

The true grade of this student is 4.00, thus showing an error in the prediction of 4.00 - 3.788 or .212 points.

The reliability of the twenty-four items of the questionnaire by means of self-correlation was found to be .464 with the boys and girls combined. By this method the sum of odd numbered items in the questionnaire was correlated with the sum of the even numbered items. Since the test is only about six minutes in length the best solution of the problem of reliability is to increase the length of the questionnaire several times. The formula $r_x = \dfrac{Nr}{1+(N-1)r}$ gives the results of increasing the length to N times its present length. Applying the formula we have $\dfrac{5 \quad .464}{1+(4 \times .464)}$ or a reliability of .812. It is necessary that the new items added to increase the length be as reliable as those already used if the results of the formula are to be valid.

CONCLUSIONS

The most important problem in making a questionnaire such as this one is to secure significant items. A vocabulary study of high school freshmen would be a desirable procedure in preparing the questionnaire. The same items

cannot be used to measure the attitudes of high school freshmen as of college freshmen. There are also special issues which are well understood by college freshmen that have no meaning to high school freshmen.

It was found impractical to try to group phrases under any special trait or tendency at least until after the significance of the reactions toward the phrases had been noted.

It would very likely be possible to compare students with high and low grades as to general tendencies, but the conclusion could scarcely be relied upon where only twenty-four significant items are used. Some general tendencies will very likely stand out when many more items are added.

The reliability of this questionnaire will have to be increased by lengthening it to probably five times its present length, as is suggested in the analysis. The new items added to increase the length must be equal in reliability to the items already used in this questionnaire in order for the reliability to be increased as prophecied by the formula given in the analysis. It will probably require a check on approximately two hundred items to obtain the desired number of additional items.

The increased multiple correlations by using the attitude questionnaire indicates that it is possible that fac-

tors in achievement other than those measured by intelli-
gence tests have been found. The low inter-correlation of
the Attitude Questionnaire with the Equation Completion Test
indicates that the two are measuring some separate factors.
It seems quite likely from the relatively high inter-corre-
lation between the Army Alpha Test and the Attitude Ques-
tionnaire that much the same factors are being measured.

The results of the questionnaire are consistent enough
to warrant further study and analysis according to plans
which have been suggested. It is the hope of the author
to obtain a new questionnaire within the next few years
from which a much better objective measurement of attitude
can be taken.

BIBLIOGRAPHY

Shuttleworth, Frank K.
   The Measurement of the Character and Environ-
   mental Factors Involved in Scholastic Success.
   University of Iowa, Iowa City.

Thurstone, L. L.
   Attitudes Can Be Measured
   American Journal of Sociology Vol.33, 1928

Thurstone, L. L.
   The Theory of Attitude Testing
   Psychological Review Vol. 35, 1929

Garrett, Henry E.
   Statistics in Psychology and Education
   Longman's Green and Co., 55th Ave., New York

Holzinger, Karl J.
   Statistical Methods for Students in Education
   Ginn and Co., Boston

Freeman, G. T.
   The Influence of Attitudes in Learning
   The Journal of General Psychology Vol. 3, Jan. 1930

Sturges, H. A.
   The Theory of Correlation Applied in Studies
   of Changing Attitude.
   American Journal of Sociology Vol. 33, 1927

Eells, Walter Crosby and Brand, Romayne
   Student Opinions in Junior Colleges of California
   School Review Vol. 38, March 1930

Terman, Lewis M.
   Tests of Character and Personality Traits
   Genetic Study of Genius Vol. 1, 1925
   Stanford University Press